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REVIEWS.

A School Text on Highway Bridge Design.

Reviewed by ALBERT WELLS BUEL.*

THE DESIGN OF HIGHWAY BRIDGES.—And the Calculation of Stresses in Bridge Trusses. By Milo S. Ketchum, M. Am. Soc. C. E., Dean of College of Engineering and Professor of Civil Engineering, University of Colorado. New York: The Engineering News Publishing Co. London, England: Archibald Constable & Co., Ltd. Cloth; 6 × 9 ins.; pp. 544; 309 illustrations, partly in the text, and 77 tables. $4 net.

A general review of this work may conveniently be introduced by a brief critical survey of the contents of its individual chapters.

Opening the book we find that 45 pages are devoted to an Introduction, and to Loads and Weights. The descriptive definitions, which largely compose the Introduction, leave much to be desired in precision and clearness, and the nomenclature here, as well as throughout the book, uses many terms in an inaccurate or provincial way. Considerable space is given to tables and diagrams of weights of steel in standard highway bridges as designed and built by three different bridge works companies. These are about the same that the estimating departments of all highway bridge companies use, but are inferior to a set that has been in use for fifteen years. No doubt they were the best available for publication. It is not clear, however, what material advantage is gained by including three sets, as the variations are not important for any purpose for which the book is intended.

The inclusion of "Live Loads for Railway Bridges," with Cooper's typical wheel loading and a number of illustrations and problems in railway bridge design, all disconnected and not correlated, goes far to make the arrangement of the book and its contents seem illogical, but, fortunately, this defect is more apparent than real.

"A brief course in the calculation of the stresses in bridge trusses" is given in the next 96 pages, following which a section of 50 pages, devoted to 24 "problems in calculation," completes Part I. This "brief course" begins with the very elements of graphical statics, not even assuming on the part of the student or reader a knowledge of the triangle of forces (on the other hand some knowledge of the calculus is presupposed). The author appears to have considerable facility in giving difficult mathematical demonstrations in a very simple and clear style, and it is therefore to be hoped that we shall have other books from his pen, treating only of the mathematical solution of engineering problems. The problems in calculation appear to have been carefully selected and arranged, and materially enhance the value of the work, especially for school use.

Part II., "The Design of Highway Bridges," is introduced by what may be termed a description of the current practice of reliable bridge companies, and 42 pages are divided into three chapters entitled "Short Span" and "High Truss" Steel Highway Bridges, and Plate Girder Bridges. With one exception all the illustrations of Plate Girder Bridges are of railway structures. Five folding plates serve to illustrate details.

The next two chapters, XIII. and XIV., occupy 59 pages, mostly devoted to extracts from specifications and tables taken from handbooks, etc. For the use of students the inclusion of this material may be desirable, but for most other purposes it is hardly in a convenient form.

Chapter XV., "The Design of Abutments and Piers," is an innovation in a book on bridges, and one that will be welcomed by many. The chapter comprises only about 40 pages, ten of which are very properly devoted to steel cylinder piers, and about an equal space to the specifications for masonry recommended by the American Railway Engineering and Maintenance of Way Association. The author has done so well with this chapter that it is a matter of regret that he has not treated the subject more in detail, giving it the attention its importance deserves. He deserves credit for departing from precedent to include it at all, and for this the users of the book should be grateful. There is no reason why substructure and abutments and piers should not be given a prominent if not a primary place in a text-book on bridge design. Possibly the reason that it has not heretofore been customary to do so is that the majority of the books on bridges have been confined to a treatment of some particular part of the subject. In fact the whole subject can hardly be done justice in one volume or by one author.

In the Chapter on "Stresses in Solid Masonry Arches" the author has succeeded in treating the elastic method in such a simple and clear way that, for the first time, it has a chance to get on speaking terms with the average engineer. This should work a great good, and forever put a stop to the perennial communications in engineering journals attacking and slandering the elastic method. But for anything more than the purely mathematical part of the problem one has to turn to the middle of the next chapter, where, sandwiched between "Stresses in Reinforced Concrete Beams and Columns" and "Culverts," there are a few unsatisfactory and in some respects misleading illustrations of reinforced-concrete arch bridges, presented without any instructive criticism or comment. In this part, also, the author illustrates (p. 385) an "8-ft. plain concrete culvert," and erroneously credits its design to Mr. Edwin Thacher, whereas it is one of a set of standard designs by the writer of this review. At another place the statement that transverse bars are placed in an arch "to resist temperature" is poorly expressed and overlooks the chief functions of transverse bars in reinforced-concrete arches.

Following a short chapter on "The Design of Timber and Combination Bridges," which would be satisfactory if it did not omit mention of the only combination bridge free from thermal stress—the Thacher truss—the author takes up "Erection, Estimates of Weights and Costs."

Erection is covered in three pages, entirely inadequately and unsatisfactorily. The notes on weight estimates and costs will be received with varying degree of approval or disapproval according to the viewpoint of the reader. The new discovery that "The rolls used in rolling sections are designed to give a section of the required weight when the rolls are new, so that sections are usually slightly heavier than the figured weights due to the wear or the spreading of the rolls," will sound strange to experienced bridge men, but it finds some explanation in a remark in the author's preface, that his knowledge was gained in "designing and contracting for highway bridges in a dozen states." The statement that estimates from stress sheets should not vary by more than 1½ to 2% from shipping weights requires to be qualified as applying only to standard spans, where the percentage of details, rivet heads and waste is very accurately known.

Part III. devotes 74 pages to "A Problem in Highway Bridge Details" and is a review of a 160-ft. Pratt truss span. This and the following 23 pages of the Appendix, in which the author offers his new specifications for Steel Highway Bridges, could have been omitted without greatly detracting from the value of the book for general use, although the author, no doubt, has found it an advantage to include this matter for the use of the students in his classes.

There are many sides to the art and business of bridge building, and it is not an easy task to judge a book fairly from the different viewpoints of all concerned, unless it is specially written for a very definite and limited purpose.

The book under review appears to have been compiled and arranged from the lecture notes, data and problems used by the author in his classes. It should therefore be primarily judged as a text-book for engineering schools. As such it seems to have valuable characteristics. But most engineering schools will probably find it too voluminous for the limited subject of highway bridges, to be preceded by a course in the design of Mill Buildings and followed by another in Railway Bridges. (The author says it "is supplementary to his 'Design of Steel Mill Buildings,' and covers the essential part of a first course in bridge design.")

It is conceded that to determine the usefulness of the work as a school text-book the opinions of men engaged in educational work will have greater value than those of a practicing engineer. But it seems that the work is also intended to meet the needs of municipal and county engineers, surveyors and all men engaged in highway bridge construction whose duties require some knowledge of design and construction, except "experienced engineers," who are almost specifically excepted. This is intended, no doubt, to mean expert bridge engineers or bridge experts.

It is natural to expect that those who have paid for their experience by long years of service in the mills and shops and in the field on erection will not place the highest estimate on experience gained from books. Possibly the time will come when there will be a royal road to a thorough knowledge of the bridge building art and "The Design of Highway Bridges" is a step in that direction. With a few exceptions, notably Chapters XV. and XVI., the only things the book contains that are not found in any one of half a dozen others are those which heretofore it has only been possible to acquire by experience in bridge work, and, preferably, with a bridge building company. If those who use the book can be brought to understand the author's statement that it "covers the essential part of a first course in bridge design," and also the limitations of purely literary knowledge of a practical subject, Professor Ketchum's work will be of inestimable value. But seemingly the author has not intended it for those who can be relied upon to have such understanding.

A very prominent bridge engineer, a few years ago, complained that there was no satisfactory text-book on bridges in existence and suggested that the writer undertake such a work. The latter, in reply, said that he only considered himself equipped to cover a small part of the field, and that such a work would be more likely to

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meet expectations if produced as the joint work of a number of competent authorities, properly coordinated and organized. An opportunity exists for some able executive, with some conception of the work involved, to associate a number of competent writers, combining experience in all branches of the subject of Framed Structures, with favorable chances of success in producing an entirely satisfactory text-book. The subject is a large one, and few men are versatile enough, combining mathematical and constructive talents in a high degree, to cover all parts of it in an authoritative manner. The very few who are properly equipped for the task, intellectually and by experience, have not been able to afford the time to do the work thoroughly. It is, at best, not a profitable field, and, generally speaking, such tasks should better be undertaken only from altruistic or educational motives.

From this point of view, therefore, too much should not be expected from the pen of any one author of a book on bridges. On the other hand, it is questionable whether any more text-books on the subject are demanded until either such a man as has been above indicated can find the time to do the work or until a collaboration of experts can be produced. It is now 36 years since Squire Whipple brought out the second edition of his enlarged and improved work entitled "An Elementary and Practical Treatise on Bridge Building," but it is a question whether a reprint of that book, with some comparatively unimportant changes to bring it up to date, would not be as well received as any recent work.

Professor Ketchum's book will, no doubt, have a large sale among certain classes interested in ordinary highway bridge problems. As the first book in many years devoted to this subject, it deserves a measure of success, at least sufficient to encourage further efforts in the same direction. It is a matter of regret that the author's treatment of the subject, in general, seems to be content with expounding current practice in ordinary highway bridge building, without making a more serious effort to elevate that practice.

The author has given substantial evidence of a high order of ability in more than one direction. A little more painstaking care in writing would make the book, in parts, easier reading, and more harmonious with his mathematical work. The typography, paper, illustrations and binding are good.

CIVIC IMPROVEMENT AND BEAUTIFICATION, CITY OF CEDAR RAPIDS, IOWA.—Report of Charles Mulford Robinson [Rochester, N. Y.] to the Mayor and City Council of Cedar Rapids. Paper; 6¼ × 9¾ ins.; pp. 13; folding and other plates.

Cedar Rapids is one of a number of American cities which is now being governed on the so-called commission plan, and it is interesting to note that one of the first acts of this commission was to call upon a man experienced in the esthetic and allied betterment of cities. Mr. Robinson found conditions at Cedar Rapids unusually satisfactory, but was nevertheless able to suggest a number of important changes. These related particularly to the provision of streets intersecting the already existing radial street system, the extension of the radial streets, the provision of additional parks and park connections and some minor improvements.

THE POLLUTION OF STREAMS BY SULPHITE PULP WASTE.—A Study of Possible Remedies. By Earle Bernard Phelps. Investigation made at the Sanitary Research Laboratory and Sewage Experiment Station of the Massachusetts Institute of Technology. Water-Supply Paper 226, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 37; one plate.

In brief space Prof. Phelps here presents an interesting study of a very important problem in stream pollution and the disposal of trade wastes. It is estimated that about 3,250,000,000 gals. of sulphite waste liquor were discharged into streams of the United States in 1906, and that this immense volume of waste contained more than 2,500,000,000 lbs. of solid matter, mostly organic. After reviewing previous studies of sulphite pulp wastes, Prof. Phelps outlines the method of making wood pulp by this process and then proceeds to state the problem involved in treating the waste liquor. Experimental investigations with the organic matter contained in the liquor are outlined, largely in chemical terms. These experiments were made in the hopes of developing commercial dyes from the substance in the wastes known as lignone.

The conclusion of the whole matter is that all processes thus far brought forward for utilizing the "immense amount of waste matter" in the sulphite pulp waste liquors have been "unsuccessful, either because there is only a limited market for the proposed product or because the suggested process is prohibitively costly." This conclusion is all the more remarkable in view of the fact that "a prize of 10,000 marks was offered in Germany in 1894 for the best method of preventing the pollution of streams by sulphite liquor, but it still remains unawarded."

MORRISON'S SPRING TABLES.—A Handbook for Engineers, Students and Draftsmen. By Egbert R. Morrison, Jun. Am. Soc. M. E. Sharon, Pa.: The Author. Cloth; 5¾ × 9¼ ins.; pp. 84. $2, net.

The formulas and tables contained in this book are intended for use in the design of springs for carrying certain loads with certain distortions. There is nothing here given relating to the design of springs for the storage of power—either motor or clock springs.

The compiler has classed helical springs made from bar less than 1/6-in. in diameter and elliptical springs of plate less than 1/16-in. in thickness as "light." One part of the book contains general and specific formulas for the deflection, length of untwisted bar, load, etc., etc., of both helical and elliptical springs. The properties of steel springs of different gage wire and plate have been computed from these formulas and tabulated. These figures are made up with a fiber stress of 80,000 lbs. per sq. in. and moduli of elasticity of 12,600,000 and 25,400,000 for helical and elliptical springs, respectively.

It should be noted that the author has kept the term "helical" in its true meaning throughout the book. In common practice true helical springs have been loosely spoken of as "spirals" creating confusion whenever it was desired to differentiate between a true spiral spring and a helix. The author will be commended on this point by those having need of his tables, even though they have to change their own definitions of different springs.

Another Book on Illuminating Engineering.

ELECTRICAL ILLUMINATING ENGINEERING.—By William Edward Barrows, Jr., Assoc. M. Am. Inst. E. E., Assistant Professor of Electrical Engineering, Armour Institute of Technology. New York: McGraw Publishing Co. Cloth; 5¾ × 8¾ ins.; pp. 216; 135 illustrations in the text. $2, net.

Three-quarters of this work is on the apparatus for the production of light from electric current, and the final third relates to the utilization of light. The work is professedly the development of lecture notes for technical students, but the plan and scope of the notes seem different from those evident in the majority of courses.

The book opens with a compilation of data on the transmitting, reflecting and absorbing qualities of various surfaces. There is much about the general performances of various kinds of light sources. The data thus presented carry no evidence of the conditions of derivations and it is evidently the author's intention to give them as general indications only.

After this general matter the author takes up the principle of photometry and describes photometric-laboratory methods and apparatus.

The various types and shapes of incandescent lamps and their many kinds of filaments are described. Next the author passes to the older forms of arc lamps and follows with descriptions of the newer developments—the luminous arcs, vapor and rarified-gas lamps.

The section on the engineering of utilization begins with a discussion of the functions of shades, globes and reflectors. This is, in turn, followed by notes on the pre-calculation of illumination—largely in respect to problems in securing uniform illumination over more or less restricted areas.

The author has, throughout, brought together many of the latest developments in lighting. The book suffers from carelessness of statement on minor points, and the effect is increased by typographical errors and omissions.

It is to be regretted that the ... has not better utilized this opportunity ... combine the results of latest development ... ple ideas of what leads to good illuminat... It is striking to note the omissions of a... cussion of the very principles on which hy... and artistic illumination depend. It woul... that the presentation of such general ide... uld be of greater benefit to young engine... l to students than giving them compar... y complicated methods of designing a ... y-uniform illumination or descriptions of ... atory apparatus not widely seen in co... practice. Advanced studies, like Steinmetz ... lt-ampere equations of the electric arc, ar... rinted to the exclusion of a simple explanat... of the difference between direct and alter... g-current arcs, and between carbon and othe... ctrodes.

It would have been possible to ... used such opportunities as touched upon for ... reater service to engineering students with... increasing the size of the volume. There are ... few more places where condensation or elimination would have been permissible. What the volume covers is in convenient and accessible form so that the reader will be sorry the author stopped short of making it a great book.

STATICS BY ALGEBRAIC AND GRAPHIC METHODS.—Intended Primarily for Students of Engineering and Architecture. By Lewis Jerome Johnson, M. Am. Soc. C. E., Professor of Civil Engineering in Harvard University. Second edition, revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 169; 13 plates and 70 text illustrations. $2; English price, 8s. 6d., net.

The second edition of Prof. L. J. Johnson's "Statics" improves on the first (reviewed in this Supplement for April 16, 1903, p. 48) by some added appendices, such as a new set of problems, a syllabus of the book, etc. The new matter will interest mainly the teacher. As a clear, accurate text-book for the study of elementary Statics the book is just as valuable as when first published.

HYDRAULIC TABLES.—The Elements of Gagings and the Friction of Water Flowing in Pipes, Aqueducts, Sewers, etc., as Determined by the Hazen and Williams Formula; and the Flow of Water over Sharp-Edged and Irregular Weirs, and the Quantity Discharged, as Determined by Bazin's Formula and Experimental Investigations upon Large Models. By Gardner S. Williams, M. Am. Soc. C. E., Professor of Civil, Hydraulic and Sanitary Engineering, University of Michigan, and Allen Hazen, M. Am. Soc. C. E. Second edition, revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 104; text illustrations and one plate. $1.50; English price, 6s. 6d., net.

The first edition of this valuable set of tables was reviewed in our issue of Sept. 14, 1905, to which our readers are referred. In the present edition, according to the preface,

the changes are confined to that part of the book devoted to the flow of water over weirs, where some new matter relating to submerged weirs is presented in the text, and where the table of discharge by Bazin's formula has been extended to cover variations of head by 0.01 ft. from zero to 6 ft., making in all a table of 30 pages instead of the two pages in the former edition. A table of discharge of high weirs, 10, 20 and 30 ft., under heads from 6 to 20 ft. has been added.

ATLAS OF CANADA.—Prepared under the direction of James White, F. R. G. S., Geographer. Department of the Interior, Canada, Hon. Frank Oliver, Minister. (Ottawa, Can.: Pub. Doc.) Cloth; 12½ × 18 ins.; pp. 21; 83 plates.

In the field of geographical publications it is generally admitted that the various governments of the world are serious rivals of the commercial publishing houses. The Canadian government has not belied the reputation in the atlas noted above. It consists of some eighty odd large plates, containing not only the usual geographical, geological and topographical maps, but also much other necessary but seldom published mapped data on telegraphs, telephones, limits of forest trees, isotherms, routes of explorers and population distribution. In addition to these maps there are the usual statistical charts on trade and commerce, population, agriculture, vital statistics, finance, currency and banking, fisheries, railways and education. Not only the material presented but the admirable arrangement and typographical work is a great credit to the Department and to Mr. James White, Geographer, under whose direction the book was prepared.

The Elementary Abstract Principles of Hydraulics and Their Application to Hydraulic Power Engineering.

Reviewed by F. C. FINKLE.*

HYDRAULIC ENGINEERING.—A Practical Treatise on the Principles of Water Pressure and Flow and their Application to the Development of Water Power, Including the Calculation, Design and Construction of Water Wheels, Turbines, and Other Details of Hydraulic Power Plants. Part I.: Hydraulics. By Frederick S. Turneaure, Dean, College of Engineering, University of Wisconsin. Part II.: Water Power Development. By Adolph Black, Adjunct Professor of Civil Engineering, Columbia University, New York. Chicago, Ill.: American School of Correspondence. Cloth; 6¼ × 9¼ ins.; pp. 267; plates and 200 text illustrations. $3.

This volume is a compilation of certain data relating to hydraulics and hydraulic power development. It consists both of matter quoted directly from other authors and magazines and of matter adapted from such authors and magazines, or from the trade publications of manufacturers. Due credit is given to these various sources of information for the material thus selected and assembled.

The name of the book is misleading, as it deals exclusively with the abstract principles of hydraulics and their application to hydraulic power engineering. "Hydraulic Engineering" is really a broad subject, covering hydraulics, hydraulic power, irrigation, public water supply, etc., while this work covers only the first two subjects.

As the treatment is strictly elementary and descriptive, rather than technically advanced and practical, the book is useful either to those beginning the study of these subjects, or to young engineers just entering upon their practice. No doubt this was the aim of the authors, as it is a production for the American School of Correspondence; and the fact is not stated as a criticism of the book, or its authors.

Part I. is devoted to abstract hydraulics. It does not pretend to cover all, or even a majority, of the principles of hydrostatics and hydrodynamics, but presents such rules and formulas as are necessary to solve the simplest and most commonplace problems only. More than this, however, cannot be expected from a treatment of the subject covering only 55 pages, as it would require at least five times as much space to make a complete presentation of abstract hydraulic science. The arrangement of this part is excellent, and it is also to be highly commended for the clear and condensed text. The figures used to illustrate the text are selected with good judgment and are so drawn as to make the important points clear to the mind.

The only article in Part I. open to much criticism is No. 28, on "Formulas for Friction Loss in Pipes." It is safe to say that hydraulicians have long since learned that the Chezy formula, with a constant coefficient for each class of pipe, is only a rough way for arriving at approximate results. Without going much into a subject so well understood among engineers as this one, it is still well to remark that an exponential formula for the flow of water in pipes gives the most accurate results for such cases. It is therefore to be regretted that a book intended to start students and beginners in the right direction should not have adopted the most scientific and advanced formula.

Part II. is given up to that branch of hydraulic engineering having to do with the development of power from falling water. The treatment of the subject is such that there is little to criticise and much to commend. This is especially true in regard to the analysis of hydraulic turbines. It begins with the very rudiments of the science and carries one up to the actual point where the theory of hydraulic motors ends and their design, construction and installation begins. The ground between these limits is well covered and the text and formulas are sufficiently full and clear to make the student's conception of the science complete.

Occasionally matter relating to the more advanced and practical side of the subject is inserted. This, however, is apparently done for the purpose of making the student realize that there is a practical application of the various theories, since it is not so complete as to assist a designing and constructing engineer in his work.

That portion of the book which includes Articles 183 to 188, possesses less value than any other. This should either have been written as a theoretical discussion of the subjects covered, or it should have been carried much further than it was. At present it is too descriptive for a scientific treatise on the design of head-gates, penstocks and hydraulic conduits in general, while at the same time the descriptive matter is either too general or confined to unnecessary details.

As illustrating matter of too general a character is that on pages 182 and 186, relating to wooden and reinforced concrete penstocks, wherein no principles are stated on which calculations can be based to determine their applicability to various conditions. Neither are the rules governing their design made so clear that a student or beginner can tell how to begin and complete the design of either.

As a sample of special detail not necessary in most cases is the recommendation, on pages 181 and 182, that buried steel plate penstocks should be kept for a year in an open trench on wooden blocks before the trench is backfilled, and a drainage ditch be constructed below the pipe and filled with pebbles and broken stone. While such precautions may be necessary in some cases, where the ground is treacherous and saturated with water, these are the exceptions and not the rule.

The reviewer cannot approve of all that is said in Article 188, and the illustrations are almost wholly inapplicable to the subject. In water-power work a distinct type has been developed for feeder conduits, or gravity conduits, as they are often called. The illustrations from Figs. 143 to 156, inclusive, are of irrigation conduits, with three exceptions: Fig. 153 being of a type of power flume which has proved very unreliable; Fig. 154 being a power flume, which had to be discarded and replaced by a tunnel in five years after its construction; and Fig. 155 being a cheap and flimsy "V" flume for floating lumber. Irrigation conduits are not suitable for use in connection with power plants. The interruption of an irrigation channel by washouts or slides occurring in storms is of slight consequence, as the water is not needed until repairs can be made. But for a power plant the water must be continuous at all times. Hence this class of service is very exacting and demands a type of construction capable of withstanding the most severe onslaught from the elements.

The matter appearing in the back of the book is very valuable to a student, as it furnishes concrete examples, showing how what precedes it may be applied in actual practice. The plants selected for description are some of those most widely known and represent many different types of construction. Improvement in two directions might have been made: (1) by including one or more of the most recent and highly improved power plants among these older ones; and (2) by differentiating those described as to their durability and efficiency, as shown by experience since their construction.

Articles 238 to 248, relating to load factors, power costs, power charges, etc., are a valuable addition to this book. While the reviewer agrees in the main with what is there said, there are two things, wherein the discussion is more or less incomplete and capable of improvement. After all, the real test of whether a water power can be made a commercially profitable development or not depends on what its output in kilowatt-hours can be delivered in the market for as compared to power from a steam plant to serve the same market. Hence in reporting on a water-power development it does not matter so much what may be its installation cost per kilowatt of rated capacity, but what its kilowatt hours will cost delivered to the consumer. In making such a comparison, there must be considered the fixed charges, depreciation, maintenance, cost of operation and load factor of the proposed water power and its possible competitor in the form of a steam plant. The result reduced to cost per kilowatt-hour for both will show the advantage of either.

In regard to charging rates to consumers, it seems to the reviewer that a more equitable and simpler method than those discussed is to charge the consumer a "readiness to serve" rate per kilowatt on his installed capacity, with an additional amount per kilowat-hour for what he consumes. If the "readiness to serve" charge is rightly made it will cover fixed charges and depreciation to the power company on its plant capacity reserved for the consumer, while the kilowatt-hour rate can be made to cover other matters relating to the actual delivery of the power and the power company's profit. Such an arrangement protects the consumer equally well, as the improvement of his load factor lessens the cost per kilowatt hour of the power he receives.

In conclusion, it may be said that this book is of value chiefly to students who are beginners in the study of this branch of hydraulic engineering. It also possesses a considerable value to young engineers practicing in the same line, who have not worked long enough to be familiar with elementary principles and some of the examples illustrating them. To such it is a valuable book of reference if used with a proper amount of caution.

To illustrate this admonition attention may be called to the fact that the vortex baffle plate shown in Fig. 56, page 74, does not in practice accomplish what is claimed for it, as its use in Mill Creek No. 3 plant near Redlands, Cal., demonstrated a tendency to throw the water vertically into the air, and this trouble was only partially overcome by heavily covering the tail race. It may also be noted that the design and arrangement of water motors for the Snoqualmie Falls plant, as described in Article 212, page 237, resulted in very poor efficiency, probably not over 60% in the water wheels themselves. Other similar differentiations might be made, but space forbids doing so.

In the foregoing review everything in the book has been discussed alike, regardless of whether it is original matter or copied from and credited to other authors.

COURS DE PONTS METALLIQUES.—Professé a l'Ecole Nationale des Ponts et Chausées. By Jean Résal, Inspecteur Général des Ponts et Chausées. (Part of "Encyclopédie des Travaux Publics," Begun by M.-C. Lechalas.) Vol. I. Paris, France: Ch. Béranger. Paper; 6½ × 10 ins.; pp. 663; 373 illustrations in the text. 20 francs; American price, $6.

The present work on metal bridges is part of an encyclopedia and follows in that series a book on "Resistance of Materials" which treats of the methods, both analytic and graphic, used in the calculation of all metal structures, particularly bridges. In the later book, the author assumes a knowledge of the general methods, but takes up the more simple theories and the practical side of metal bridge design, fabrication and construction. The work is extremely long and bulky, so much so that it will have small value to the American engineer. It is, however, an exhaustive treatise, which should have a large field in its own country and among those who are studying the large problems of bridge design.

ON THE AMELIORATION OF RIVERS WITH UNSTABLE BEDS BY THE SYSTEM AUDOUIN.—Translated from the French at the Engineer School, 1908. No. 34, Occasional Papers, Engineer School, U. S. A. Washington Barracks, D. C.: The Engineer School. Paper; 6 × 9 ins.; pp. 40; folding and other plates, and text illustrations.

The contents of this pamphlet are better explained by the sub-title, which reads as follows:

"On the Amelioration of Rivers with Scourable Bottoms and Especially of the Loire: Extract from Nouvelles Annales de la Construction, April, 1904. Followed by a Project for a Trial of the Oblique Dams with Suspended Movable Vanes (System Audouin). By M. Chemin, Ingenieur en chef des Ponts et Chaussées en retraite, Formerly Professor at National School of the Ponts et Chaussées."

The system which is described comprises a wing dam, with vanes or shutters moving up and down in a vertical plane, which is thrown out from the convex point of a compound curve in a river, so as to clear out the sand bar which is liable to form at this point.

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A Satisfactory Text-Book on Steam Boilers.

Reviewed by CARL C. THOMAS.*

STEAM-BOILERS.—By Cecil H. Peabody, Professor of Naval Architecture and Marine Engineering, and Edward F. Miller, Professor of Steam Engineering, Massachusetts Institute of Technology. Second edition, revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 434; 5 plates and 176 text illustrations. $4; English price, 17s., net.

There are not many books which are well adapted to the use of college students as texts on the subject of Steam Boilers. This book is preeminently suited to that purpose, and in its revised form it contains a satisfactory amount of material, well selected, for use by students and others wishing to obtain a knowledge of the principles underlying steam boiler design and operation. It is well understood that nothing but actual engineering experience in design and operation can make a competent engineer, but that a certain part of the mental equipment required can be obtained by the careful study of well-written books dealing with fundamental principles. The text-book should afford discussions of such fundamentals, and may properly illustrate them by showing how they have been applied in practice. All this is supplied in the book by Professors Peabody and Miller, and a considerable portion of the book deals with processes used in building boilers, and with considerations bearing upon the selection of accessories, settings, stokers, and other features of a boiler plant.

A fault, however, shared by many books on technical subjects, is found in parts of this book, in that specific directions and statements are set forth as of general application, which in reality apply only in special cases. There are comparatively few such statements in the present book, and these would not mislead any but inexperienced engineers. The tensile strength of cast iron in its various forms is not at the present time limited to between 12,000 and 20,000 lbs. per sq. in., as stated on page 191. A better statement would place it at from 18,000 to 25,000 lbs. The writers qualify the first statement by saying that special care and skill result in the attainment of tensile strength in cast iron made from special stock, and called gun iron, of 30,000 lbs. per sq. in. This figure might be raised considerably and would more nearly represent present practice if the figure given were 36,000 lbs. Again, the strength of triple-riveted boiler-shell joints, like that shown on page 214, is not necessarily represented by an efficiency of between 85 and 90%. In frequent cases, where such joints are designed with reference to steam-tightness as well as to economy in manufacture, the least efficiency may not exceed 80% and is sometimes considerably lower than that. This criticism applies particularly in cases where the shell plating is thicker than that used in the example worked out in the book; as, for example, in large cylindrical internally fired boilers.

In these and a few other places the book might be criticized as being written from an academic standpoint, but, at the same time, a book for use by teachers in technical schools is usually better suited to its purpose if written by a capable teacher than if written by a practicing engineer. Professors Peabody and Miller are eminent teachers; their book is carefully written, and the few points open to criticism do not affect the value of the book to any serious extent. The only other book covering essentially the same ground and adapted for use as a text is H. de B. Parsons' "Steam Boilers," also an excellent book for the use of college students or for reference by the engineer.

The arrangement of Peabody and Miller's "Steam Boilers" will commend itself especially to teachers. Chapter I. deals with some of the leading types of boilers and contains a few well-chosen illustrations. Chapter II., dealing with superheaters, is one of the additions to the second edition of the book. It gives a brief treatment of this important subject, and might have been extended somewhat to good advantage. There is, however, a large amount of information available in recently written technical papers dealing with the use of superheaters. References to such papers would be welcome additions to this chapter. Chapter III., on fuels and combustion, outlines the theory of the subject and gives numerical examples of methods of calculation. This is followed by a chapter on corrosion and incrustation, showing the effects produced by chemical action in boilers and outlining methods used for preventing deterioration.

Chapter V. deals with boiler settings, furnaces and chimneys, while Chapter VI. discusses methods of estimating boiler horsepower. The remainder of the book deals in detail with the structure and strength of boilers, describes boiler accessories, shop practice relating to boiler construction, and the testing of boilers. Chapter XII. deals with the design of stationary boilers, particularly of the horizontal return-tubular type. The example worked out is representative, and will be of use to those giving instruction in this subject, as well as to engineering students in general. An appendix gives various tables of particulars relating to special types of boilers and their settings, data regarding fuel economizers, and other tables applying in a general way to the subject of steam boilers. Five folding plates in the back of the book give detailed drawings of certain types of fire tube boilers and of the design of a brick smokestack. These designs have evidently been taken from practice and are useful as illustrations of the subject matter of the book. The subject of steam piping, expansion joints, etc., has received additional consideration in this edition.

The subject of steam boilers is one which can hardly be treated fully in one volume, and it is interesting to classify some of the books which have been written on various phases of the subject. They may be arranged somewhat as follows:

(1) Compendiums of general and specific information pertaining to boilers. Examples: Boilers, their construction and strength, by Thomas W. Traill, R. N.; A Treatise on Steam Boilers, by Wilson and Flather; Steam Boilers, Their History and Development, by H. H. P. Powles; Steam Boilers, W. H. H. Shock; Useful Things to Know About Steam Boilers, G. B. N. Tower, Supervising Inspector, American Steam Boiler Insurance Co.; A Manual of Steam Boilers, R. H. Thurston; Steam Boilers, W. M. Barr.

(2) Books pertaining to efficiency tests and experiments bearing on boiler performance, F. J. Rowan, The Practical Physics of the Modern Steam Boilers; Bryan Donkin, The Heat Efficiency of Steam Boilers.

(3) Treatises on special classifications of boilers. Examples: Bertin and Robertson, Marine Boilers; C. E. Stromeyer, Marine Boiler Management and Construction; Dr. G. Bauer, Marine Engines and Boilers; Leslie Robertson, Water Tube Boilers.

(4) Treatises on theory of heat with special reference to steam generation. Example: Practical Treatise on Heat, by Thomas Box.

(5) Text-books aiming to state general principles of design and construction, and to give examples of their application. Examples: H. de B. Parsons, Steam Boilers; Peabody and Miller, Steam Boilers.

The last-mentioned book, by Professors Peabody and Miller, which has been noticed at length above, is one of the standard text-books in use in the leading technical institutions of this country, and it is certain to continue to occupy a high place among the many books that have been written on steam boilers.

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VALVE SETTING.—Simple Methods of Setting the Plain Slide Valve, Meyer Cut-Off, Corliss and Poppet Types. Compiled and written by Hubert E. Collins. New York and London: Hill Publishing Co. Cloth; 6 × 9¼ ins.; pp. 209; 200 illustrations in the text. $2.

The main part of this book consists of detailed directions for setting the valves of steam engines, including piston valves, the riding cut-off, gridiron, Corliss, Porter-Allen, Wright and Fitchburg types. In the latter part of a chapter on air compressors, directions are given for setting the valves of compressors and blowing engines. These directions are supplemented with adequate illustrations of the valves and valve gears, and are, as a whole, sufficiently explicit and clear. The compiler gives his assurance that they have in each case been referred to the engine builder for approval. This portion of the book occupies about three-fourths of the total number of pages.

About this nucleus of good mat[illegible] have unhappily been clustered a few stray [illegible]pters which would be less regrettable were th[illegible] not marred by a widespread dubiety in the le[illegible]ing of the figures. This defect is particularl[illegible]nnoying in the chapter on the Zeuner valve d[illegible]am and in the first part of the chapter on air [illegible]mpressors. It is hard, also, to understand just [illegible] a chapter on the D slide valve, in which the [illegible]uner diagram is used with the evident ass[illegible]ption that the reader is already familiar with i[illegible]hould precede a chapter explaining the diag[illegible] It may be well to note at this point that [illegible]tailed instructions for setting the plain D sl[illegible] valve are not given. It may possibly be with[illegible]e idea of offsetting this deficiency that there [illegible]ucked in near the back of the book an article [illegible]the cross exhaust for duplex pumps, which [illegible]ears also in "Pumps," by the same compiler, [illegible]viewed in our issue of Dec. 17, 1908.

Apart from these supplementary [illegible]pters, the valve setting instructions themselves [illegible]re a valuable addition to this class of literat[illegible]re in that they collect in one book information otherwise obtainable only from a number of [illegible]idely scattered sources. It is possible, too, tha[illegible] the undesirable portions noted above may do no harm—although, for example, the misprinting of the exponent, 1.41, as a coefficient or multiplier throughout the equations for adiabati[illegible] expansion in the chapter on compressors, might tend to confuse someone not fairly familiar with thermodynamics.

ASPHALTS.—Their Sources and Utilizations. Asphalt for Dustless Roads; Recent Improvements in Asphalt Industries; Together with Addenda Treating on General Waterproof Construction. By T. Hugh Boorman, Civic Engineer and Asphalt Expert. New York: William T. Comstock. Cloth; 6½ × 10 ins.; pp. 168; plates and text illustrations. $3.

The preface states, among other things, that this book was suggested by a series of articles that appeared some time since in "Architects' and Builders' Magazine." Since the numbers containing these articles ran out of print, there has been a continuous call for them, and the request was made that they be issued in book form. . . . .

I have endeavored, without fear or favor, to give credit to all producers of asphalt in every country and clime and to give to all their due. . . . .

This book is the result of 36 years of active life among asphalt mine owners, refiners, importers, exporters, manufacturers and contractors, and, as will be seen, has taken me to many countries, in all of which I have endeavored to glean information from all interested, from presidents of corporations to the humblest stirrer of an asphalt kettle.

As might be expected from a book having such an origin, the volume consists chiefly of quotations from various papers and reports. It is useful in bringing together in one place a considerable amount of information on many phases of asphalt and its uses, which was previously widely scattered. The author does not appear to have given the reader very much of the benefit of his "36 years of active life" among asphalt men, in so far as criticism of the opinions of others or expression of his own opinions is concerned. The illustrations are all half-tones, and many of them have no particular relation to the subject, further than that they show buildings in some portion of which asphalt was used. Most of the half-tones, however, are excellent examples of this type of engraving and add to the popular interest of the book.

THE WATER POWERS OF WISCONSIN.—By Leonard S. Smith; Engineer, Wisconsin Geological and Natural History Survey. Pub. Doc.; Madison, Wis. Cloth; 7 × 9¾ ins.; pp. 354; illustrated.

The preface states that few other States are so favorably situated in regard to water-power as is Wisconsin.

While single developments of from 10,000 to 20,000 HP. are not wanting, it is their general distribution over nearly the entire state, rather than the neat size of a few plants, that is most characteristic of Wisconsin water powers. The total water power in the state at present developed, approximately 130,000 HP., is only a small proportion of the total power awaiting development.

In order to secure greater publicity, the State Legislature of 1905 appropriated $2,500 for making surveys of the water-powers and for preparing a report on the results. The present report (which is classed as Bulletin XX. of the Wisconsin Geological and Natural History Survey) is stated to be a first step in furnishing the information needed by the public. It includes also the run-off records of the U. S. Geological Survey in

Wisconsin from 1902 to the end of 1907. After a review of the physical geography of the State, the individual description of various river systems is taken. This includes their topographic and hydraulic features, and the various water-power development plants. This part of the book covers nearly 300 pages. In addition, about 17 pages are devoted to a tabulated chronological list of the grants of dam charters or privileges by the Legislature of Wisconsin from 1838 to 1907. The book is illustrated by numerous maps and diagrams, and by half-tone engravings of views of the rivers, dams and development works.

Metallurgical Experiments.

Reviewed by W. Campbell.*

LABORATORY EXPERIMENTS IN METALLURGY.—By Albert Sauveur, Professor of Metallurgy and Metallography in Harvard University, and H. M. Boylston, Instructor in Mining and Metallurgy in Harvard University. Cambridge, Mass.: The Authors. Cloth; 7¾ × 10¾ ins.; pp. 73; 17 text illustrations and 10 tables. $1.25.

This book consists of short notes written primarily for the use of students at Harvard University, who take the courses in General Metallurgy and in the Metallurgy of Iron and Steel.

The book is divided into two parts. The first contains 13 experiments in general metallurgy: coking and proximate analysis of coal; calorimetry—the Parr calorimeter; pyrometry—the Siemens water pyrometer, the Mesuré and Nouel optical pyrometer, the Le Chatelier thermo-electric pyrometer; the melting points of tin, lead and zinc; reduction of copper oxide by carbon; reduction of lead oxide by carbon; reduction of iron oxide by metallic aluminium—the thermit reaction; reduction of copper oxide by copper sulphide; reduction of lead oxide by lead sulphide.

Part Two consists of 13 experiments in iron and steel as follows: influence of carbon upon the tenacity, elasticity and ductility of iron; the influence of nickel on the tenacity, elasticity and ductility of iron; the thermal critical points of steel; the changes in magnetic properties occurring at the thermal critical points; relation between the critical points and the hardening power of steel; the brittleness produced by hardening; the hardness produced in high carbon steel by sudden cooling (quenching) from a high temperature; influence of hardening upon the ductility, elasticity and transverse strength of steel; influence of carbon upon (1) the hardness, (2) the hardening power of steel; influence of the nature of the quenching bath upon the hardening of steel; tempering of hardened steel; influence of certain heat treatments upon the physical properties of steel; effect of annealing on the properties of cold worked steel; effect of heat upon the grain of steel.

There are several tables in the text, such as typical analyses of various fuels; corrections for decrease in weight of iron and copper cylinders of the Siemens water pyrometer; temperatures, tables for use with the Mesuré and Nouel; melting points of metals; thermochemical data, etc. After each experiment is attached the laboratory report to be filled by the student.

In Part One the choice of experiments has been well made. Experiment 5 might have been increased by the addition of the melting and freezing point of copper and an explanation of the method of calibrating the Le Chatelier pyrometer. As the Wanner and Féry pyrometers have found much favor in the works, it is to be hoped that they may be added in a subsequent edition.

In regard to the second part of the book 9 of the 13 experiments require the use of a testing machine, and this does not as a rule form part of the equipment of a metallurgical laboratory. However, metallurgical students generally have access to such a machine in the engineering departments. The experiments chosen serve to emphasize the influence of carbon in the physical properties and the relation of the critical points to the hardening power of steel.

The book as a whole is to be commended for its simplicity and clearness. A few experiments have been chosen to demonstrate to the student the fundamental principles involved, and these experiments have evidently been written up from notes of actually performed work. In the second place they call for thought on the part of the student, rather than the mere performance.

In the teaching of metallurgical laboratory work, the personal leanings of the instructor are a great factor in the choice of what is taught. In this book, the work is so broadly laid out that it will serve as a basis for courses of widely different aspect. For example, though only three metals are given under the section on the Le Chatelier pyrometer, other metals such as antimony, aluminium, copper or various alloys may be used. This is specially true of Part Two where the work can be very easily expanded by using other material and by the addition of metallographic examination of the specimens used, contrasting structure with treatment, composition and physical properties.

The authors are to be congratulated on turning out a book for which there is a growing demand.

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A Revision of Schuyler's Reservoirs.

RESERVOIRS FOR IRRIGATION, WATER-POWER AND DOMESTIC WATER-SUPPLY.—With an Account of Various Types of Dams and the Methods, Plans and Cost of Their Construction. By James Dix Schuyler, M. Am. Soc. C. E., M. Inst. C. E., etc. Second edition, revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 6½ × 10¼ ins.; pp. 573; 381 illustrations, mostly in the text, and 6 folding plates. $6.

The revision and enlargement of this book has added materially to its size and value. The author states that the present edition includes 234 new illustrations. Many of these are photographs, "some of which have been taken by the author's pocket camera—an inseparable companion." About 60% of all the illustrations are said to be new, and as much or more of the reading matter either new or rewritten.

In review of the first edition of this book, which was published in our issue of June 13, 1901, we said:

> Aside from brief statements of the principles involved in the design and construction of each type of dams, and criticisms of the various structures reviewed, the book, in the words of Mr. Schuyler,
>
> is chiefly a straightforward description of those works with which the author has become familiar, either as consulting engineer, or as designer and constructor, or merely as an interested observer of the work of other engineers.
>
> When well presented, as this one is, books of the kind described often form the most useful sort of technical literature.

The book should still be judged chiefly as a collection of descriptions of the large and otherwise important dams of the world. As such it is of the highest value.

One of the new and unique features of the present edition is the comparative sections of masonry and earth dams which the author has assembled on plates, all sections being drawn to the same scale. There are three of these sheets for masonry dams. One sheet shows cross-sections of 9 dams in Spain and 22 in France; another shows 35 sections of dams in other foreign countries; the third of these plates shows sections of 29 American dams. Of earth dams 15 are shown, on three plates. Three of these structures are in California, and the others are located in Great Britain, Ireland, India and France. Sections of many of these earth dams are also given in Wegmann's "The Design and Construction of Dams," but in that work each is exhibited on separate sheets.

Besides the plates just mentioned, the appendix contains a valuable table showing the acre-foot cost of 75 reservoirs, of which 45 are in the United States and 30 in foreign countries. The character of each dam is stated, the capacity of the reservoir in acre-feet, the total cost and the cost per acre-foot. For users of the book other than those interested solely in irrigation, time would have been saved had the author based his capacity and unit costs on millions of gallons of capacity, and if he could also have given it in cubic feet the convenience of the table would have been still further increased. These suggestions seem pertinent in view of the title of the book—"Reservoirs for Irrigation, Water-Power and Domestic Water-Supply." As a matter of fact, it seems likely that the users of this book, if divided into classes, would fall in reverse order. Irrigation engineers, only, are in the habit of considering water in acre-foot units.

The foregoing quotation of the title of the book also suggests that the leading word would have been far more descriptive of the contents of the volume had it been "Dams" instead of "Reservoirs." The origin of the work, however, may account for the fact that reservoirs are given first place. As some of our readers know, the first edition of the book was an enlargement of a paper prepared by the author a dozen years ago, to form one of the Water-Supply and Irrigation Papers issued by the U. S. Geological Survey.

Other minor criticisms of the book might be made, such as some relating to matters of arrangement, particularly the placing of statements of principles governing the design or construction of the different types of dams sometimes in one part and sometimes in another part of the chapter devoted to each type. But no one really ought to find much fault with a book which contains such a vast amount of useful information as does this one, particularly when the information as a whole is in accordance with the plan of the author, is quite convenient for reference purposes, and much of it is nowhere else accessible. The wonder is that so busy a man as Mr. Schuyler should have found time to collect and put into so good shape for publication such a large amount of valuable material.

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OSKAR NAGEL, Ph. D.

P. O. Box 385 NEW YORK

Ocean Transportation.

THE OCEAN CARRIER.—A History and Analysis of the Service and a Discussion of the Rates of Ocean Transportation. By J. Russell Smith, Ph. D., Assistant Professor of Industry in the Wharton School of Finance and Commerce, University of Pennsylvania, Author of "The Organization of Ocean Commerce," etc. New York and London: G. P. Putnam's Sons and Railroad Age Gazette. Cloth; 5 × 7¾ ins.; pp. 344; 38 plates. $1.50.

We cannot too highly commend this book. The subject of shipping is one that appeals to popular interest; but it is one on which at least 99% of educated Americans are densely ignorant. The generation that lived in the days before the Civil War, when American ships sailed on every sea, knew perfectly the conditions of the sea trade of that day; but the sea trade of the present differs as greatly from the conditions then prevailing as those conditions differed from conditions in the days of Columbus and Drake.

A vast deal has been written concerning the disappearance of the American flag from the high seas, concerning the decline of such once famous seaports as Salem and New Bedford, concerning the fact that American goods shipped to South America are sent by way of Europe instead of direct, concerning the profits of the shipping business. And much the largest part of all that appears on these and kindred subjects, in the newspapers, in popular magazines, and particularly in the addresses of public men, is either the result of dense ignorance or is based on that partial knowledge which is proverbially dangerous.

We wish this book might be read by every American business man and professional man, and particularly by every man in public life. The business of sea transport affects every individual in the land. The rates and facilities for sea traffic are closely related to the cost of

the necessaries of life and the earnings and profits of ten thousand industries. Prof. Smith's book gives the facts regarding this great industry in complete form and with a broad grasp of essentials and a clear understanding of the economic factors in the industry that commands admiration.

Withal the book is written in most entertaining style. It is as fascinating as a novel. Much more interesting in fact than nine-tenths of the productions of current fiction writers. Its treatment of the subject is popular rather than technical and the book is all the more valuable for it. One or more copies ought to be placed in the library of every engineering school and its reading might well be required in the course.

The student will gain from it some history and economics that he will obtain from no other source, in addition to accurate knowledge concerning a world industry that may at some future day be of great value to him.

The Power Gas Producer.

Reviewed by ALFRED E. FORSTALL.*

MODERN POWER GAS PRODUCER.—Practice and Applications. A Practical Treatise Dealing with the Gasification of Various Classes of Fuels by the Pressure and Suction Systems of Producer. By Horace Allen, Author of "Gas and Oil Engines," etc. New York: D. Van Nostrand Co. Cloth; 5 × 7½ ins.; pp. 326; 136 illustrations in the text. $2.50, net.

Although nowhere so stated, directly, it appears from a reference in the preface that this book is a reprint of a series of articles which originally appeared in "The Practical Engineer," with the addition of an appendix dealing with several forms of producers developed since the articles were written. Periodical literature may be judged leniently, but there is no object in publishing in book form matter on a subject that has been treated in so many books in recent years as has that of producer gas and gas producers, unless the book so produced differs from its predecessors either in treating the subject from an entirely original point of view or in containing new matter which brings the knowledge of the art down to date. In neither way does the book under review justify its existence.

About half of it is devoted to descriptions of gas producers, both pressure and suction, made by different manufacturers, and the impression given by this portion is that it is composed of extracts from catalogs or descriptive circulars issued by these various manufacturers. A collection of descriptions of this character has value in enabling a person fairly well versed in the art to compare different types of apparatus and study the different solutions of the problems involved in the design of gas producers. The catalogs and circulars themselves can be easily obtained, however, and descriptions of, with one or two exceptions, European types of apparatus, without any comment as to what is good and what is bad in their design, are not of much service to the American student of producer gas practice.

The use of this matter is responsible for conflicting statements confusing to a person seeking information. Take for instance the subject of the relative advantages of the rival methods of obtaining from bituminous coal, gas free from tarry matter. One of these methods is to pass the volatile products, driven off from such coal, through a layer of incandescent fuel for the purpose of decomposing the hydrocarbon vapors in these products, and the other is the removal of the tar mechanically after the gas has left the producer and has been cooled. One who was in doubt as to which of these methods was the better would not have his doubts removed by reading on page 59 that since the first method was only partially successful and complicated the apparatus it was better to employ the second, and on page 139 that the first method being the best should be employed to prevent condensible vapors from being mingled with the gas, especially since these contradictory statements are made with reference to two types of apparatus made by one and the same firm.

The other half of the book deals briefly with natural gas in England and the application of producer gas to the propulsion of boats, and at slightly more length with various chemical and physical properties of gases, including specific heat, calculation of the volume of gas produced from a given weight of fuel of known composition, calorific value, flame temperatures and explosive pressures and gas analysis and calorimetry. The final chapter gives information in regard to the English patents, granted during 1906 and 1907, which bear upon the subject of producer gas.

In the chapter on specific heat a table is given which shows that the specific heats of gases are greater at high than they are at low temperatures, but later on specific heats at ordinary temperatures are employed in the calculation of flame temperatures and nothing is said as to the error which this introduces into the calculation.

All through the book are found examples of carelessness in expression, such as calling the initial temperature the "absolute initial temperature" and thus confusing it with the absolute temperatures that are being used in the same paragraph.

Taken as a whole, the book is written in a rather slipshod manner, which might have been excusable in the original articles, but should have been corrected when they were published in book form. If there were no other books on the subject this one would have value, but it is not equal to several of its predecessors.

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Five Recent German Books.

DIE AUSNUTZUNG DER WASSERKRAEFTE.—Technische und Wirtschaftliche Grundlagen. Neuere Bestrebungen der Kulturländer. By E. Mattern, Regierungsbaumeister, Kgl. Wasserbauinspektor. Second edition, greatly enlarged. Leipzig, Germany: Wilhelm Engelmann. Paper, 6½ × 9½ ins.; pp. 652; 256 illustrations in the text.

LEHRBUCH DES HOCHBAUES.—Edited by Karl Esselborn. Vol. II.: Gebäudelehre, Bauformenlehre, die Entwickelung des Deutschen Wohnhauses, das Fachwerks- und Steinhaus, Ländliche und Kleinstädtische Baukunst, Veranschlagen, Bauführung. By Josef Durm, Karl Esselborn, Bernhard Kossmann, Emil Beutinger, Karl Stief, Heinrich Stumpf, Georg Rüth, Reinhard Weder. Leipzig, Germany: Wilhelm Engelmann. Paper; 7½ × 11 ins.; pp. 429; numerous illustrations in the text. 15 marks; American price, $6.

DER WASSERBAU.—Für Studierende und Praktiker. By M. Strukel, Professor at the Finland Technical College in Helsingfors. Part II.: Water-Supply, Sewerage, Drainage, Irrigation, and Canals for Navigation. Second edition, revised and enlarged. Leipzig, Germany: A. Twietmeyer. Paper; 7½ × 10½ ins.; pp. 239; 23 plates and 29 illustrations in the text. 16 reichsmarks.

DIE RATIONELLE AUSWERTUNG DER KOHLEN ALS GRUNDLAGE FUER DIE ENTWICKLUNG DER NATIONALEN INDUSTRIE.—Mit Besonderer Berücksichtigung der Verhältnisse in den Vereinigten Staaten von Nordamerika, England und Deutschland. By Franz Erich Junge. Berlin, Germany: Julius Springer. Paper; 6½ × 9½ ins.; pp. 91; ten illustrations in the text. 3 marks; American price, $1.20.

ZUSAMMENGESETZTE FESTIGKEITSLEHRE NEBST AUFGABEN AUS DEM GEBIETE DES MASCHINENBAUES UND DER BAUKONSTRUKTION.—Ein Lehrbuch für Maschinenbauschulen und Andere Technische Lehranstalten sowie zum Selbstunterricht und für die Praxis. By Ernst Wehnert, Instructor in the Municipal Trade and Mechanical School at Leipzig. Berlin, Germany: Julius Springer. Cloth; 6 × 9 ins.; pp. 224; 142 illustrations in the text. 7 marks; American price, $2.80.

Mattern's "Water-Power Development," reviewed in these columns Nov. 15, 1906, now appears in second edition, but meanwhile it has more than doubled in size. The general plan is the same: discussion of all those aspects of water-power development which concern the project as a whole; mainly commercial matters, such as cost and earning power, but necessarily embracing many technical questions. Roughly, half the book deals with engineering details, treating them sketchily, however, and not in the manner of a technical treatise; this, of course, is all that the purpose of the book demands. The other half is occupied by various matters on cost of works, selling price of electric power, relation of operating schedule to variations of water flow, etc., and with a review of recent hydro-electric work in the several civilized countries, statistical matter, legislation, etc.

Students of building in the architectural sense will find interesting illustrations and an intelligent text in the second volume of "Lehrbuch des Hochbaues." It contains condensed historical chapters on house-building, interiors, public buildings and churches, a chapter on styles and three chapters on German dwelling houses and other buildings. Estimating and s[illegible]ying also have a chapter each. Speaking g[illegible]rally, the book contains nothing whatever to interest the engineer as such.

A descriptive synoptic review of water-supply and water purification, sewerage and sewage disposal, drainage, irrigation works and navigation canals is found in Strukel's "Wasserbau," Part II. It is a modernized re-edition of an earlier work, and follows by three years the second edition of Part I., reviewed Feb. 16, 1905, p. 183. The principal part of the text is a series of short descriptive paragraphs explaining the illustrative drawings, the latter being grouped on 23 two-page plates at the back of the book. The work is too condensed to be of much service to the practicing engineer, but can be useful as a text-book in connection with fuller development of the subject by lectures.

A study in economics appears under the German equivalent of Rational Utilization of Coal. Its character and scope may be indicated by two of the author's conclusions: first, that it is wrong and wasteful to consume by direct combustion coals which might yield by-products in appreciable quantity, i. e., bituminous coals; second, that the exploitation of the coal resources should be under national control, to ensure maximum efficiency of utilization.

Mr. E. Wehnert dignifies the subject of Combined Stresses with a separate volume, though not a very bulky one. But his book is not a treatise; it may fairly be called an elementary text-book, as it employs the "common theory" instead of the abstruse theory of elasticity. Also, the mathematical work—and the entire volume is wholly mathematical—is held down to simple algebraic processes for wider availability. In order to accomplish the latter, of course, it is necessary to give deflection of formulas without proof. Some other integrations are reduced to algebraic form by expressing them as infinite series. The arrangement and method of the book are praiseworthy. We believe, however, that the subject is so intimately a part of the general subject of stresses, i. e., Mechanics of Materials, as to leave no place in school instruction for its segregation in a separate book. On the other hand, a comprehensive treatise, making due reference to results of experiment, should prove a worthy addition to engineering literature.

HIGH STEAM-PRESSURES IN LOCOMOTIVE SERVICE.—(A Review of a Report to the Carnegie Institution of Washington.) By W. F. M. Goss. Bulletin No. 26, University of Illinois Engineering Experiment Station. Urbana, Ill.: The University. Paper; 6 × 9 ins.; pp. 45; 21 illustrations in the text.

The conclusions of this report, and a discussion thereon, were given in Engineering News of Nov. 22, 1906, and Jan. 10, 1907, respectively.

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A Railway Employee on Railway Accidents and Management.

CONFESSIONS OF A RAILROAD SIGNALMAN.—By J. O. Fagan. Boston and New York: Houghton Mifflin Co. 4¾ × 7½ ins.; pp. 181; eight plates. $1.

As long ago as 1880 an authority on railway statistics said that "the chances of accident in railroad traveling are so small that they are not materially increased by any amount of traveling which can be accomplished within the limits of a human life." Doubtless this still holds true, though the percentage of accidents is increasing faster than the travel. From 1896 to 1906 the passenger mileage on the railways of the United States increased 100% and the number of persons injured in accidents 167%. And in this very increase in totals the horror of the individual accident overshadows the small chance of the occurrence of that accident.

The public has come to believe in the ability and honesty of intention of the railroad man. Whenever there has occurred an accident in a combination of man and mechanism it has become the habit to ascribe it to the failure of the mechanism, or if plainly there was human error the accident generally was charitably called unpreventable. This tendency has naturally been fostered by the men who manage and who are employed by the railways. It is therefore with some degree of surprise and no little admiration that one reads Mr. Fagan's book, which holds entirely different views.

J. O. Fagan is a remarkable man. A cable-layer and operator in South America in his youth, later a gold digger and a trader in the Transvaal, he became, over twenty years ago, a signal operator on a New England railroad. Except for short periods, when he was the chief clerk to a superintendent, he has spent the best part of his mature life as a towerman in the yards of Cambridge, Mass. All of this time he has been studying, from the inside, the railway industrial problem, and this book, first published as a series of papers in the "Atlantic Monthly," is a result of that study as it pertains to safety of railway operation. It is extremely well written, in a clear and forceful style, and must command the attention of the traveling public as well as the consideration of the railway man, however the latter may view the opinions of the author.

It is estimated by Mr. Fagan that "fully 85% of the fatalities that occur on our railroads can be directly traced to the negligence of employees." For this negligence the fault lies equally with the employee and with the management; with the former on account of his purely selfish views of his duties and obligations; with the latter because of its lack of control of the organization. In the early days of railroading the employee was under the absolute domination of the management; his rights were few and those little respected. In gradual revolt against this industrial slavery, labor unions were organized, which, step by step, forced recognition from the operators until at present the railway employee is one of the freest and most liberally treated of all labor's army. But this freedom brought with it the evils which are threatening the safety of railway travel; a feeling of personal superiority over rules on the part of the employee and a lack of discipline in enforcing those rules on the part of the management. Those regulations which are founded on obvious reasons, the trainman will readily observe, but when he comes to the point of choosing between his own judgment, based on limited observation, as against the (to him) non-comprehensible rules of the management, founded on general practice, it is generally the latter that go by the board. When the regulations have been broken and an accident ensues, the management, worried and threatened by the labor union, generally omits to make a public exposure of the negligent employee or of the carelessness back of the accident, but contents itself with a more or lesser effective personal and secret reprimand. And two weeks later the same error is again made by an employee who had not heard of the first.

In a word, then, according to Mr. Fagan, the mechanism is ahead of the man. How this is to be remedied the present book does not attempt to say, though the author is now publishing in the "Atlantic Monthly" a series of constructive articles to offset the destructive criticisms of his first book. If there is any solution to the problem it is, in the opinion of Mr. Fagan, to be found in the popular modern philosophy of loyalty. The labor leader must attempt the achievement of more than higher wages, he must instill in the men a sense of their responsibility toward themselves, their road and finally and most important, the people at large, for whom and, in the end, by whom the railway is managed. The management, on its part, must become more independent of the influence of the men. And the general resumé of the whole case, as well as the author's attitude toward his work, are best expressed in his own words:

> In the first place, it will be evident that the safety problem on American railroads must be taken in hand and solved by the people. The present tangled condition of affairs can be straightened out only by supreme authority.
>
> And our second conclusion is the revelation that the area in American industrial life covered by these preventable railroad accidents and the causes that lead up to them is practically, at the present day, a *terra incognita*. Of course the railroad man who steps out from the rank and file, and undertakes to give away the plans and topography of the country for the benefit of those who are interested in improving conditions, exposes himself to all sorts of cynical criticism in the minds of his fellows. However, as a matter of fact, your true philosopher thrives in this kind of atmosphere. He is born of the battle and the breeze, and spends a lifetime in fortifying the walls of his "tub," into which, when hard beset, he retires to enjoy himself.

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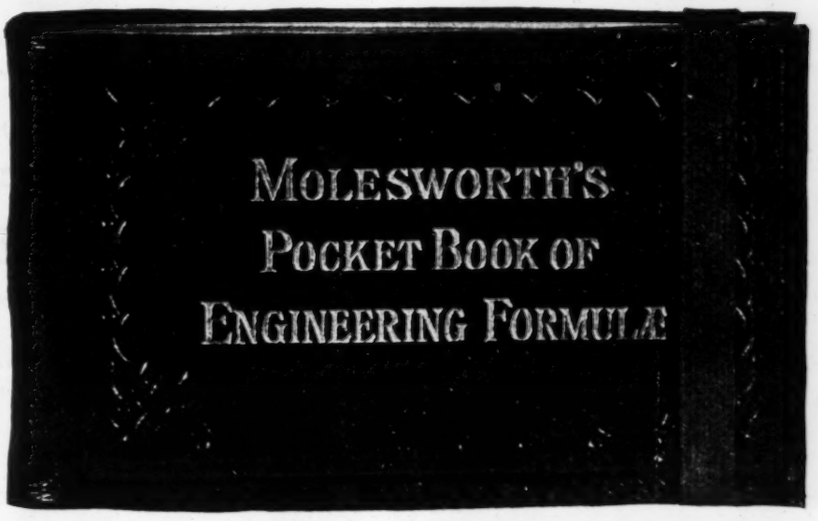

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Health Protective Work in New York State, 1907.

NEW YORK STATE DEPARTMENT OF HEALTH.—Annual Report for the Year Ending Dec. 31, 1907. (Eugene H. Porter, M. A., M. D., Commissioner.) In two volumes. Albany, N. Y.: Pub. Doc. Cloth; 5½ × 9 ins.; pp. 763 and 869; folding and other plates, and one folding map in pocket.

That a much-needed extension of the health-protective work of the great state of New York, both in scope and character, has at last been made, is evidenced by these two large volumes. The part that engineering plays in the work of any well-organized board of health is indicated by the fact that the larger of the two volumes is devoted to the Sanitary Engineering Division. The first volume, however, contains much information of interest and value to engineers as a class, while for any wide-awake person there is scarcely anything in either volume, from cover to cover, that would not prove interesting and instructive if only the average well-informed citizen had sufficient time to read such voluminous reports. For those who have not the time, the general review of the work of the Department, by Dr. Eugene H. Porter, Commissioner of Health, and some of the shorter reports, is available. Dr. Porter outlines the activities of all the branches of the Department during the year, and offers suggestions regarding needed future extensions of the work. Other features of the first volume deserving mention here are the special report on vital statistics by Prof. Walter F. Willcox, Consulting Statistician, of Cornell University, together with several papers presented at a conference of sanitary officers of the state; also, the report of Dr. Herbert D. Pease, Director of the Hygienic Laboratory. The last-named report contains a considerable amount of information based on examinations of municipal water-supplies of the state. Prof. Willcox's report on vital statistics is intended to serve as a digest and interpretation of the report of the Division on Vital Statistics which is given in the first volume. Valuable comments on estimating population are made by Prof. Willcox, and as a supplement to his report there is a discussion by Prof. James McMahon, of Cornell University, entitled "Method of Estimating the Present Value of the Net Prospective Earnings Lost by Deaths from Tuberculosis in New York State in One Year."

In the second volume, Mr. Theodore Horton, M. Am. Soc. C. E., Chief Engineer of the Health Department, takes up in succession the examination of plans for sewerage and sewage disposal during the year, investigations of sewerage and sewage disposal made in various localities, the protection of public water-supplies, including rules for the purpose, investigations of stream-pollution complaints and various other nuisances, and special investigations of the drainage areas of the Oswego, Mohawk and Genesee rivers. In addition, there are reports of inspections of the sanitary condition of the cities of Ogdensburg, Niagara Falls and Poughkeepsie, and of the sewage-disposal plants of the state, both municipal and private, and of summer resorts on Long Island and in the Catskills, and finally of ice harvesting on the Mohawk and Hudson rivers. The inspections of sanitary conditions in the three cities named were prompted by the unduly high typhoid rates in these and some of the other cities of the state. Further investigations of this sort will be made. The three reports in the present volume were prepared by Prof. H. N. Ogden, Assoc. M. Am. Soc. C. E, Special Assistant Engineer, of Cornell University

Perhaps the portion of the whole report which will be most gladly welcomed by engineers will be the 100 pages devoted to descriptions of the 29 municipal and 26 institutional sewage-disposal plants. This special report was also prepared by Prof. Ogden, but most of the descriptions were written by Mr. C. L. Walker, Special Engineering Inspector of the Department, who examined most of the plants described. This special report contains outline plans of various disposal plants, most of which are prepared from sketches made by Mr. Walker at the time of his visits to the plants. Many photographs taken by Mr. Walker are also given. The descriptions of the various plants give a good general idea of their character.

We cannot refrain from suggesting that the usefulness of these two volumes would have been increased had some of the matter been presented in more condensed form. It is always questionable, for instance, whether a state department is warranted in publishing, so fully as is here done, such proceedings as those of the sanitary conference reported in the first volume. It would also seem particularly advantageous to have cut down some of the correspondence pertaining to the approval of plans for proposed sewage disposal works. It is, of course, convenient to a state department to have all or a considerable part of such correspondence available for reference in printed form, but much of it is necessarily of local and temporary value, and it seems that some of it in this case might better have been left for the department files. The space thus gained could be well used, perhaps, to give more extended descriptions and fuller illustrations of sewage-disposal plants actually constructed.

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THE FINANCIAL HISTORY OF WISCONSIN.—By Raymond Vincent Phelan, Ph. D., Instructor in Economics, University of Minnesota. A Thesis Submitted for the Degree of Doctor of Philosophy, University of Wisconsin, 1908. Madison, Wis.: The University (Bulletin No. 193). Paper; 6 × 9 ins.; pp. 293. 50 cts.

In writing his Financial History of Wisconsin Mr. Phelan had to deal with a period of only seventy years (1836 to 1905), the first 12 of which related to territorial government and required only brief consideration. After reviewing constitutional provisions relating to finances, the author discusses the public debt, trust funds, the sale and management of State lands and the general financial administration of the State. The bulk of the volume deals with taxation. Under taxation of railways and other public-service corporations, is the material of most interest to our readers. In general, taxation of railways and the like was on the gross revenue basis until 1905, when it was changed to a cash-valuation basis, determined mostly from the market value of stock and bonds. The History makes no mention of the important part played by engineers in the valuation of public-service corporation property in Wisconsin, because it stops short of the date when most of that work was begun.

Educational Statistics

COMMISSIONER OF EDUCATION.—Report for the year Ended [illegible] 30, 1907. Vol. 2. Washington, D. C.: Pub[illegible] Cloth; 5¾ x 9¼ ins.; pp. 523 to 1,214; 184 table[illegible]

A va[illegible]ss of statistics, with comparatively little t[illegible]s here given regarding the common schools[illegible]y schools, universities, colleges and technol[illegible]l schools, agricultural and mechanical col[illegible]e, professional schools, and a variety of othe[illegible]ducational institutions of the country.

In the course of the introduction to the statistical t[illegible]s, Prof. Edward L. Thorndike, of the Teache[illegible] College, Columbia University, makes some interesting remarks, from which we quote a few paragraphs as follows:

I estimate that our account as a nation for the year 1906-7 stands somewhat as follows: We use in formal school education a material plant valued at from $1,200,000,000 to $1,300,000,000, the labor of 550,000 teachers or other educational officers, and more or less of the time of some 18,000,000 students, equivalent roughly to the time implied by 150 days' attendance on elementary school by 12,500,000 children, by a full year's work in a school of secondary grade by 1,000,000 boys and girls in their teens, and by a full year's work in a college, professional school, or other institution, by 200,000 young men and women.

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As a partial estimate of the returns from this investment we may take the number of students whose education has been carried to a specified standard of accomplishment and power. Thus I estimate that in 1907 3,000 students reached the standard denoted by three years or more of academic, technical or professional study in advance of a reputable college degree; that 25,000 students reached the standard denoted by at least three and not over four years of such study in advance of a four-year high school course; that 125,000 students reached the standard denoted by at least three and not over four years of study in advance of an eight-year elementary-school course; and that 750,000 students reached the standard of completion of an elementary-school course of seven or eight years or its equivalent.

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Small Tools.

Reviewed by WILLIAM W. BIRD.*

HANDBOOK OF SMALL TOOLS.—Comprising Threading Tools, Taps, Dies, Cutters, Drills and Reamers. Together with a Complete Treatise on Screw-Thread Systems. By Erik Oberg, Associate Editor of "Machinery," Author of "Shop Arithmetic for the Machinist." New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¼ x 8¼ ins.; pp. 517; 282 illustrations in the text, and 134 tables. $3; English price, 12s. 6d., net.

Small tools is a subject on which but little information is to be found in existing treatises on shop practice, and that little only in scattered articles. The author has brought together much of this scattering information and in addition presents a first-class view of modern practice gained by years of experience with one of the foremost small-tool manufactories in this country. The book is written for practical men, though theoretical considerations have not been overlooked.

Much space is devoted to tables, formulas, and general matter of service to the designer and the toolmaker. A large portion of the book is given over to screw threads and the methods of producing them. The information on this subject is very complete. The various screw-thread systems in general use are described in detail, together with their essential differences, advantages and disadvantages. In all, eight chapters are devoted to the various methods of producing threads with thread tools, chasers, taps and dies and the proper method of making these tools. In a book of this character which gives more or less of the history of the various screw-thread systems, Mr. Albert M. Powell, of Worcester, Mass., should have been given credit for the Achme thread.

Two chapters are given to milling cutters, one to reamers, and one to drills, counterbores, hollow mills and lathe arbors.

Under the heading, "Kind of Steel Used for Taps," the author remarks that "Ordinary Carbon steel or tool steel should be used for all kinds of taps." After spending so much time in getting together all of this material on taps, it is to be regretted that something more could not have been written with regard to the various kinds of tool steel and the amount of carbon best suited for taps.

In referring to drill tests made at the Worcester Polytechnic Institute the author states that 45° is the best angle for all drill points, but the report on these tests stated that this was only true for high-speed steel.

The author should also correct his statements regarding the A. S. M. E. standard machine screws. The American Society of Mechanical Engineers approved, but did not adopt, these standards.

The 134 tables and 283 illustrations given in this book, together with the fact that the book is well indexed, renders it valuable as a work of reference for any one connected with the machine shop. It is unquestionably the best book that has appeared on the subject of small tools.

INDUSTRIAL EDUCATION.—The Annals of the American Academy of Political and Social Science. Issued Bi-Monthly. Vol. XXXIII., No. 1, January, 1909. Emory R. Johnson, Editor. Philadelphia, Pa.: The Academy (36th and Woodland Ave.). Paper; 7 x 10 ins.; pp. 224. $1 per number.

BEGINNINGS IN INDUSTRIAL EDUCATION.—And Other Educational Discussions. By Paul H. Hanus, Professor of the History and Art of Teaching in Harvard University. Boston and New York: Houghton Mifflin Co. Cloth; 4¾ x 7½ ins.; pp. 199. $1, net.

It is a significant sign of the times that demands are now being made in almost every quarter for material changes in the education of the youth of the land. Much information on this subject is contained in the two publications noted above. The "Annals" for January contains 23 essays on industrial education, mostly descriptive of industrial or trade schools which have been in operation for periods ranging from a considerable number of years to a few months. These descriptions include schools at Columbus, Ga., Springfield, Mass., New York, Philadelphia, Milwaukee, and Manila, P. I., under public direction, besides a number of schools connected with private business enterprises, such as those of the General Electric Co. at West Lynn, Mass., and the Store School of John Wanamaker, in Philadelphia.

The leading essay is on the "Relation of Industrial Education to National Progress" and is by Mr. Booker T. Washington, Principal of the Tuskegee Institute, Ala. Col. Carroll D. Wright reviews "The Work of the National Society for the Promotion of Industrial Education." Prof. Herman Schneider, Dean of the College of Engineering, University of Cincinnati, writes of "Partial Time Trade Schools." The attitude of labor unions to industrial education, according to statements by Mr. John Golden, President of the United Textile Workers of America, Fall River, Mass., is far more sympathetic than is generally understood. What the unions object to, according to Mr. Golden, is not industrial education, but the sort of schools which are established chiefly for providing low-waged and incapable substitutes for trained workmen or for supplying strike breakers.

The small book by Prof. Hanus, noted above, contains a number of essays on industrial education, but the busy man will find the meat of these essays in the first one, which gives title to the volume. In this first essay, the general problem of industrial or vocational education is well stated. The problem is, and it may be noted that the author agrees in general with the writers of the many essays in the "Annals," not only to train boys and girls for life work with their hands, but also to bridge over and profitably utilize the time of boys and girls between the ages of, say, 14 and 17, when their services in shops and factories are not wanted as a rule, owing to their immaturity. The result is that boys and girls of this age who drop out of the ordinary school, as is the case of perhaps 90% of school-children, are unable to find anything to do which really contributes toward their training for progress in the arts or industries. They earn comparatively little money, and forget nearly all they have learned during their school-days. The aim of the industrial or vocational school is to keep the boy and girl learning for two or three years beyond 14, taking up chiefly training of the hand and eye in industrial occupations, but not neglecting the so-called cultural studies.

The results of the investigations of the Massachusetts Industrial Commission are set forth in Prof. Hanus' book. Besides the essays noted, this book contains one on the Industrial Continuation Schools of Munich and several on other phases of secondary education.

Publications Received.

THE ECONOMY FACTOR IN STEAM-POWER PLANTS.—By George W. Hawkins. New York: Hill Publishing Co. Cloth; 6 x 9½ ins.; pp. 133; 49 illustrations, partly in the text, and numerous tables. $3, net.

ENTWURF EINES WASSERKRAFTWERKES IM GEBIET DER MURG OBERHALB FORBACH.—By Th. Rehbock, Professor in the Grand-ducal Technical College "Fridericiana" at Karlsruhe. Leipzig, Germany: Wilhelm Engelmann. Stiff paper; 8¼ x 13 ins.; pp. 47; 22 plates and 2 text illustrations. 8 marks; American price. $3.20.

ETUDE SUR L'AVIATION.—By Maurice de Canteleu. Paris, France: Ch. Béranger. Paper; 6½ x 10 ins.; pp. 128; 45 illustrations in the text.

DIE FORTSCHRITTE AUF DEM GEBIETE DER ELEKTRISCHEN FERNBAHNEN.—Erfahrungen und Aussichten auf Grund von Betriebsergebnissen. By O. C. Roedder. Wiesbaden, Germany: C. W. Kriedel. Stiff paper; 7¼ x 10¾ ins.; pp. 323; 172 illustrations, mostly in the text. 12.60 marks; American price, $5.

FOUNDRY PRACTICE.—A Treatise on Molding and Casting in Their Various Details. By James M. Tate and Melvin O. Stone. Prepared for the Use of Students in the College of Engineering, University of Minnesota. Third edition, revised. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 4¾ x 7½ ins.; pp. 234; 112 illustrations in the text. $2; English price, 8s. 6d., net.

GEOLOGIC ATLAS OF THE UNITED STATES.—U. S. Geological Survey, George Otis Smith, Director. No. 160: Accident-Grantsville Folio, Maryland-Pennsylvania-West Virginia. Washington, D. C.: Pub. Doc. Paper; 18½ x 21¾ ins.; pp. 14; nine plates.

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HEAT ENERGY AND FUELS.—Pyrometry, Combustion, Analysis of Fuels and Manufacture of Charcoal, Coke and Fuel Gases. By Hans v. Jüptner, Professor, Imperial and Royal Technical Institute, Vienna. Translated by Oskar Nagel, Ph. D. New York: McGraw Publishing Co. Cloth; 6 × 9½ ins.; pp. 306; 118 illustrations in the text and 136 tables. $3.

ILLUSTRATED TECHNICAL DICTIONARY.—In Six Languages: English, German, French, Russian, Italian, Spanish. Edited after a novel method by K. Deinhardt and A. Schlomann, Engineers. New York: McGraw Publishing Co. London: Archibald Constable & Co., Ltd. Munich-Berlin: R. Oldenbourg. Paris: H. Dunod & E. Pinat. St. Petersburg: K. L. Ricker. Milan: Ulrico Hoepli. Madrid: Bailly-Ballière é Hijos. Cloth; 4 × 7¼ ins.

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INDUSTRIAL ACCIDENTS.—MEXICAN LABOR IN THE UNITED STATES.—Bulletin of the Bureau of Labor, No. 78, September, 1908. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 417 to 644.

THE INTERNAL COMBUSTION ENGINE.—Being a Text Book on Gas, Oil and Petrol Engines, for the Use of Students and Engineers. By H. El. Wimperis, Assoc. M. Inst. C. E., Assoc. M. Inst. E. E., Whitworth Scholar. New York: D. Van Nostrand Co. Cloth; 5½ × 8¾ ins; pp. 326; 114 illustrations in the text. $3, net.

THE INTERPRETATION OF TOPOGRAPHIC MAPS.—By Rollin D. Salisbury and Wallace W. Atwood. Professional Paper 60, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 9 × 11½ ins.; pp. 84; 170 plates and 34 text illustrations.

IRRIGATION IN WYOMING.—By Clarence T. Johnston, State Engineer. Prepared under the direction of Samuel Fortier, Chief of Irrigation Investigations. Bulletin 205, Office of Experiment Stations; A. C. True, Director. Washington, D. C.: Pub. Doc. Paper; 6 × 9 ins.; pp. 60; 3 plates and 22 text figures.

LAW AND BUSINESS OF ENGINEERING AND CONTRACTING.—With Numerous Forms and Blanks for Practical Use. By Charles Evan Fowler, M. Am. Soc. C. E. New York: McGraw Publishing Co. Cloth; 5¾ × 9 ins.; pp. 162; text illustrations. $2.50, net.

LEHRBUCH DES TIEFBAUES.—Edited by Karl Esselborn. Third edition, enlarged. Vol. II.: Grundbau, Brückenbau, Wasserversorgung und Entwässerung der Städte, Wasserbau. By Karl Esselborn, Theodor Landsberg, Eduard Sonne and Leo v. Willmann. Leipzig, Germany: Wilhelm Engelmann. Paper; 7½ × 11 ins.; pp. 524; 1,800 illustrations in the text. 15 marks; American price, $6.

LOSSES OF IRRIGATION WATER AND THEIR PREVENTION.—By R. P. Teele, Expert in Irrigation Institutions, Office of Experiment Stations. (Reprint from Annual Report of the Office of Experiment Stations for the Year Ended June 30, 1907.) Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 369 to 386; four illustrations in the text.

MINERAL RESOURCES OF THE UNITED STATES.—Calendar Year 1907. U. S. Geological Survey, George Otis Smith, Director. In two parts. Washington, D. C.: Pub. Doc. Cloth; 5¾ × 9 ins.

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Part II.: Nonmetallic Products. Pp. 897; one plate (in pocket) and six text figures.

MINING METHODS IN EUROPE.—Written after a Visit to Many of the Metal and Coal Mines of Great Britain, France and Germany. By Lucius W. Mayer. New York and London: Hill Publishing Co. Cloth; 6 × 9½ ins.; pp. 169; 92 illustrations in the text. $2.50, net.

NATIONAL COUNCIL OF COMMERCE.—Proceedings of the First Annual Meeting, Held at the Office of the Secretary of Commerce and Labor, Dec. 10, 1908. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 28.

NATIONAL FIRE PROTECTION ASSOCIATION.—Quarterly. Vol. II., No. 3, January, 1909. Hartford, Conn.: Henry A. Fiske, Editor (P. O. Box 1284). Paper; 6¼ × 9 ins.; pp. 271 to 389; illustrated. $1 per copy.

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REGISTRATION OF BIRTHS, MARRIAGES AND DEATHS (Ontario).—Report for the Year Ending 31st December, 1908. (W. J. Hanna, Registrar-General.) Toronto, Ont.: Pub. Doc. Paper; 6¼ × 9½ ins.; pp. 39 + cxcvii.

REPORT ON THE MINING AND METALLURGICAL INDUSTRIES OF CANADA, 1907-8.—Eugene Haanel, Ph. D., Director Mines Branch, Department of Mines, Ottawa, Canada: Pub. Doc. Paper; 6½ × 9¾ ins.; pp. xvi. + 972; numerous folding and other plates, 20 drawings and 6 maps. $1.

SAND.—Its Use and Application in the Various Industries and Processes. By W. S. Reed. (Authorized reprint from Vol. XXV., No. 3 (July, 1908), of the Copyrighted Proceedings of The Engineers' Club of Philadelphia.)

SHORT CUTS IN CARPENTRY.—A Collection of Useful Problems Giving New and Improved Methods of Laying Out and Erecting Carpenters' Work. By Albert Fair, Author of "Steel Square as a Calculating Machine," etc. New York: Industrial Publication Co. Cloth; 4¾ × 7½ ins.; pp. 90; 1 folding plate and 72 text illustrations. 50 cts.

STATE ENGINEER (South Dakota).—Biennial Report to the Governor, for the Years 1907-1908. (Samuel H. Lea, State Engineer.) Pierre, S. Dak.: Pub. Doc. Cloth; 6 × 9 ins.; pp. 208.